lege, Cambridge (in addition to 10,000*l* given during his lifetime), 10,000*l.*; the Royal Victoria College, Montreal (under deduction of any payments made during his lifetime, and in addition to the college buildings and site provided by him at a cost of about 80,000*l.*), 200,000*l.*; Yale University, Connecticut, U.S.A., 100,000*l.*; the University of Aberdeen for chair of Agriculture, 5000*l.*; Queen's University, Kingston, Canada, extension fund, 20,000*l.*; the principal Church of Canada Presbyterian College, Montreal, 12,000*l.*

The second volume of "Statistics of Public Education in England and Wales" for 1911–12–13 has been published by the Board of Education (Cd. 7204). It is concerned wholly with financial statistics. The first table in the volume shows that the total expenditure of the Board of Education in 1912–13 out of the Parliamentary vote amounted to 14,329,551*l.*, as against 14,302,859 for 1911–12. During 1912–13, 11,748,331*l.* was spent on public elementary schools, 749,359*l.* on secondary schools, 585,871*l.* on technical schools and classes, and 583,127*l.* on the training of teachers. Among other grants made by the Board during the financial year mentioned were 41,647*l.* to university institutions in respect of technological work, 35,000*l.* to the Imperial College of Science and Technology, as compared with 20,000*l.* in 1911–12, 17,790*l.* to the Science Museum at South Kensington, 20,590*l.* to the Geological Survey, and 2202*l.* to the Committee on Solar Physics.

The annual report of the distribution of grants for agricultural education and research in the year 1912–13 (Cd. 7179, price 8½*d.*), recently issued by the Board of Agriculture and Fisheries, shows a very satisfactory advance on the older state of affairs. The new scheme made possible by the establishment of the Development Fund has now been in operation for a sufficient number of months to prove that it is in the main very satisfactory, and can accomplish the work it was intended to carry out. The general plan is set out very lucidly in an introduction by Mr. T. H. Middleton, and a number of details are given in the appendix, so that the reader can form a sufficient idea of the scheme and its working. For the first time scientific research is recognised as the starting point, and the sum of about 30,000*l.* per annum is, or will be, available for the research institutes that have been set up; in addition 3000*l.* per annum is granted for special investigations not quite falling within the scope of the research institutes. These institutes are not charged with the investigation of specific local problems or with the elaboration of technical details; their business is to elucidate the fundamental principles underlying the relationships of the soil, the plant, and the animal, and they have a perfectly free hand in the management of their affairs. They are:—Imperial College of Science and Technology, for plant physiology and pathology; Agricultural Department, Cambridge University, for animal nutrition and for plant breeding; Rothamsted Experimental Station, for soil problems and plant nutrition; Bristol University, for fruit growing; Royal Veterinary College, for animal pathology; University College, Reading, for dairying; University of Birmingham, for helminthology; University of Manchester, for economic entomology; University of Oxford, for agricultural economics.

The annual general meeting of the Royal College of Science Old Students' Association was held at the college on January 31, the president (Dr. A. E. H. Tutton, F.R.S.) in the chair. Prof. H. E. Armstrong, F.R.S., was elected president for 1914, his place as one of the vice-presidents being filled by the election of Mr. A. T. Simmons. Mr. J. Allen Howe and Mr. T. Ll. Humberstone were re-elected treasurer and secretary respectively. After the regular business, the report of the Royal Commission on University Education in London was discussed, with special reference to the recommendations relating to the college, and the following resolutions were adopted unanimously:—(1) That the Imperial College of Science and Technology should be organised as a federation of colleges under a common government, each college being managed by a special committee; (2) that the Royal College of Science, the Royal School of Mines, and the City and Guilds (Engineering) College should be included in the federation, together with a fourth college devoted to higher teaching and research in Technology; (3) that if, and when, the Imperial College is linked more closely with the University of London, the Royal College of Science, London, should, while remaining in the proposed federation of colleges, become a "constituent college" of the University in the faculty of science. The committee was empowered to make representations under these resolutions. The annual dinner of Old Students was held in the evening at the Criterion Restaurant, Dr. Tutton presiding. Sir John Rose Bradford, Sec.R.S., proposed the toast of the evening, "The Royal College of Science, London, and the Old Students' Association," and Sir William Ramsay, F.R.S., and Prof. S. J. Truscott replied for the guests. The guests also included Dr. Herringham (Vice-Chancellor of the University), Sir Alfred Keogh, K.C.B., Mrs. Ayrton, Prof. Bateson, F.R.S., and Dr. Frank Heath.

SOCIETIES AND ACADEMIES.

London.

Royal Society, January 29.—Sir William Crookes, O.M., president, in the chair.—Prof. O. W. **Richardson**: The origin of thermal ionisation from carbon. In a paper recently communicated to the society by Dr. J. N. Pring, experiments bearing on this subject were described. The smallness of the observed currents and the variation of them with the pressure and nature of the gas, led Dr. Pring to the conclusion that considerable doubt was thereby cast on the theory of the emission of electrons from hot solids, and that these effects were to be attributed to chemical action. In the present paper the magnetic field due to the large heating currents employed by Dr. Pring are shown to curl up the paths of the electrons, and so prevent them from reaching the electrode. It is shown that with the larger currents none of the electrons could reach the electrode in these experiments, and owing to the complexity of the apparatus it is impossible to say what proportion would reach it at the lower temperatures. In the opinion of the author of this paper, the conclusions referred to cannot be regarded as established by the experiments under consideration.—Prof. W. H. **Bragg**: The X-ray spectra given by crystals of sulphur and quartz. A crystal of quartz is found, on examination by the X-ray spectrometer, to contain three interpenetrating hexagonal lattices of silicon atoms and six of oxygen. The angles of reflection in a number of important planes all agree, within 1 or 2 per cent., with the calculated values. Sulphur contains eight interpenetrating lattices, each of the kind formed by placing an atom at each corner of a rectangular parallelopiped and in the centres of two opposite faces. The edges of the parallelopiped are in the known ratios of the crystallographic axes.—Prof. L. N. G. **Filon**: The temperature variation of the photo-elastic effect in strained glass. The experiments described in this paper were undertaken to see whether the double refraction produced in glass by stress was at all affected by change of temperature. The results show that the refractive indices for rays polarised in and perpendicular to the line of stress are unequally affected, but seem increased on the whole by rise of temperature. One of these, however, shows a permanent residual change even after cooling. This is important as showing that this property of the glass is affected by previous temperature treatment.—J. H. **Shaxby** and Dr. E. Emrys **Roberts**: Studies in Brownian movement. Paper i., The Brownian movement of the spores of bacteria.—Dr. R. **Whiddington**: The transmission of kathode rays through matter.—Ezer **Griffiths**: The variation, with temperature, of the specific heat of sodium in the solid and liquid state; also a determination of its latent heat of fusion. The specific heat of sodium (melting point 97·6°) was investigated at various temperatures in the range 0° to 140° by the electrical method. The range of temperature through which the metal was heated was about 1·5°, thus enabling the actual specific heat at each particular temperature to be determined. In the solid state the specific heat is considerably influenced by the nature of the previous heat-treatment, and two distinct specific heat-temperature curves are obtained for the annealed and the quenched state. The increase in the values of the specific heat in the solid state is very marked as the melting point is approached. In the molten state the specific heat decreases with temperature, the relation between specific heat and temperature from 100° to 140° being linear. The latent heat of fusion was found to be 27·52 gram calories.—Dr. G. **Green**: Natural radiation from a gas. The investigations of Planck have established the result that the total energy emitted from a black body at any temperature consists of discrete quanta, all equal and similar. If we identify the "energy quantum" as the energy contained in the light pulse emitted each time a molecule undergoes structural change, the determination of the form of this light pulse might lead to useful information regarding the constitution of the molecule. In this paper the form of pulse, in which the energy per wave-length is the same as that required by Planck's law of radiation at any temperature, is first derived. This form accordingly represents the total radiation from any black body at any temperature. The radiating body is now taken to be a gas. By decomposing the above pulse we obtain an infinite succession of wave-trains emitted by the various groups of molecules obtained by arranging the total number according to speed.—Dr. T. E. **Stanton** and J. R. **Pannell**: Similarity of motion in relation to the surface friction of fluids. The paper deals with an experimental investigation of the existence of the similarity of motion in fluids, of widely differing viscosities and densities, in motion relative to geometrically similar surfaces, which has been predicted from considerations of dynamical similarity by Stokes, Helmholtz, Osborne Reynolds, and Lord Rayleigh.—A. E. **Oxley**: The influence of molecular constitution and temperature on magnetic susceptibility.—N. **Eumorfopoulos**: The boiling point of sulphur on the thermodynamic scale.

Challenger Society, January 28.—Sir John Murray in the chair.—C. Tate **Regan**: A bathypelagic angler-fish (*Melanocetus johnsoni*), from the North Atlantic, having inside it a Scopeloid fish (*Lampanyctus crocodilus*) three times its own length. The specimen was taken at the surface of the sea, and it was supposed that the struggles of the captured fish, before it was completely swallowed, had brought the captor up from the depth at which it normally lives. Curiously enough, the only other examples of Melanocetus in the British Museum, two in number, were of nearly the same size (3 in. long), and each contained a Lampanyctus of 8 or 9 in.—G. P. **Farran**: The Copepoda of a set of serial tow-nettings from the west coast of Ireland. In gatherings taken over a series of years at ten-mile intervals on a line running sixty miles west of co. Kerry, out of eighty-five species that occurred, four were neritic and showed a uniform decrease both in numbers and frequency of occurrence at every ten miles from the shore. Sixty-six were oceanic, and showed a uniform increase seawards over the same stations, while twelve species varied irregularly and seemed to be euryhaline.

MANCHESTER.

Literary and Philosophical Society, January 13.—Mr. F. Nicholson, president, in the chair.—W. **Cramp**: Some notes on the measurement of air velocities, pressures, and volumes. The author described the instruments generally used, and the results he obtained with a special apparatus he set up for testing them. His results were summarised as follows:—(1) For accurate tests of fans, &c., a Brabbée tube and a micromanometer, or a good facing gauge with a side gauge having its orifice flush with the pipe wall and used with a micromanometer, are far more accurate than the older methods. (2) The pneumometer may be specially useful where the air is laden with dust, &c. (3) The Nipher collector is very inaccurate. (4) In ordinary round or square pipes the coefficient of contraction is rarely less than 0·9.

PARIS.

Academy of Sciences, January 26.—M. P. Appell in the chair.—The **President** announced the death of Sir David Gill, correspondant for the section of astronomy.—G. **Bigourdan**: The determination of the thermometric coefficient of the wire micrometer. The method recently devised by M. Lippmann for the autocollimation of a telescope can be utilised for the rapid and accurate determination of the focal length of the objective of the telescope, and this, combined with the measurement of the linear value of one turn of the micrometer screw and the coefficient of the wire gives a solution of the problem.—G. **Humbert**: Some remarkable numerical functions.—H. **Deslandres** and A. **Perot**: Contribution to the realisation of high magnetic fields. Concentration of the ampere-turns in a very small volume. The method is partly based on the use of a stream of petrol cooled to −30° C. by a liquid ammonia machine, for cooling the wire carrying the current of the electromagnet, and partly on a modification of the winding of the electromagnet. The field thus obtained was 51,500 Gauss, with a current of 24 amperes.—E. **Roux**: Remarks on antigonoccic vaccines. A reference to the work of P. Mayoral and P. Grandez bearing on the recent publication of C. Nicolle and M. Blaizot on the same subject.—M. **Gambier**: Bertrand's curves and curves of constant curvature.—E. **Keraval**: A family of triply orthogonal systems.—H. **Andoyer**: New fundamental trigonometrical tables.—Th. **Anghelutza**: The left symmetrical nucleus in the theory of integral equations.—Ernst **Lindelöf**: Conformal representations.—Georges **Rémoundos**: The convergence of series of analytical functions.—A. **Châtelet**: Congruences of higher order.—G. **Armellini**: The analytical solution of the limited problem of three bodies.—M. **Swyngedauw**: The resistance of safety spark-gaps.—Eugène **Darmois** and Maurice **Leblanc**, jun.: The possibility of an alternating arc in mercury vapour. It was shown by Cooper-Hewitt that the mercury arc in a vacuum acts as a valve for an alternating current, and this has been utilised for conversion of alternating into continuous current. The authors describe conditions under which it is possible to maintain an alternating arc in mercury vapour for low frequencies and moderate voltages.—G. **Moreau**: Flames containing chlorides giving an electromotive force.—MM. **Hanriot** and **Lahure**: The minimum temperatures of annealing. The time during which the metal is heated to a given temperature has a considerable influence on the softening of the metal. The experiments were carried out on zinc and silver.—Marcel **Delépine**: The iridium chlorides.—Michel **Longchambon**: The rôle of magnesia in sedimentary cycles.—Maurice **Durandard**: The ferment of *Rhizopus nigricans*. The mycelium of this mould contains a very active ferment: its action on milk is a maximum at 50° C.—Raoul **Combes**: The presence of yellow pigments capable of being transformed into anthocyanine in leaves and flowers not forming anthocyanine.—Henri **Piéron**: The decrease of the ratio of the latent period to the period of total establishment for luminous sensations as a function of the intensity of stimulation.—Henri **Bierry** and Albert **Ranc**: The proteid sugar of the blood plasma.—M. **Lécaillon**: The analogies of structure which exist betweent the ovary of certain insects and that of certain Branchipodids (*Chirocephalus stagnalis*).—L. **Joleaud**: The geology of the Filfila djebel (Algeria).—J. **Repelin**: The geological constitution of the septentrional part of the department of Var.—René **Nicklès**: The section of the Lias, the Infralias, and the Trias of Lorraine in the boring of Bois Chaté. This boring was made for coal, and penetrates to the Upper Permian. No coal-bearing strata were found.

BOOKS RECEIVED.

Forty-second Annual Report of the Local Government Board, 1912–13. Supplement containing the Report of the Medical Officer for 1912–13. Pp. lxx+412. (London: H.M.S.O.; Wyman and Sons, Ltd.) 4*s*.

A Text-book of Domestic Science for High Schools. By M. G. Campbell. Pp. vii+219. (London: Macmillan and Co., Ltd.) 4*s*. net.

Descriptions of Land. By R. W. Cautley. Pp. ix+89. (London: Macmillan and Co., Ltd.) 4*s*. 6*d*. net.

Annuaire pour l'an 1914, publié par le Bureau des Longitudes. Pp. vii+502. (Paris: Gauthier-Villars.) 1.50 francs.

Ueber Gedächtnis, Vererbung und Pluripotenz. By Prof. V. Haecker. Pp. 97. (Jena: G. Fischer.) 2.50 marks.

Indian Administration. By Prof. V. G. Kale. Pp. iv+298. (Poona: Arya Bhusham Press.) 1.4 rupees.

Der Fischerbote. vi. Jahrgang. No. 1. (Hamburg: L. Friederichsen and Co.)

Zur Frage der Entstehung maligner Tumoren. By Prof. T. Boveri. Pp. 64. (Jena: G. Fischer.) 1.50 marks.

The Religious Revolution of To-day. By Prof. J. T. Shotwell. Pp. ix+162. (Boston and New York: Houghton, Mifflin Co.) 1.10 dollars net.

Neue Denkschriften der Schweizerischen Naturforschenden Gesellschaft. Band xlviii. Pp. vii+347+iv plates. (Zürich: Zürcher und Furrer.)

Finlandisch Hydrographisch-Biologische Untersuchungen. No. 12. Jahrbuch 1912. Enthaltend Hydrographische Beobachtungen in den Finland Umgebenden Meeren. Edited by Dr. R. Witting. Pp. 130+vi plates. (Helsingfors.)

R. Osservatorio di Catania. Catalogo Astrofotografico 1900, o Zona di Catania. Vol. iv., Parte 1. Pp. 153. (Catania.)

A Critical Revision of the Genus Eucalyptus. By J. H. Maiden. Vol. ii., part 9. (Sydney: W. A. Gullick.) 2*s*. 6*d*.

Columbia University in the City of New York. Publication No. 7 of the Ernest Kempton Adams Fund for Physical Research. Neuere Probleme der Theoretischen Physik. By Prof. W. Wien. Pp. 76. (Leipzig und Berlin: B. G. Teubner.)

The Cancer Problem. By C. E. Green. Third edition. Pp. 98+plates. (Edinburgh and London: W. Green and Sons.) 5*s*. net.

Experimentaluntersuchung zur Messung von Erderschütterungen. By Prof. L. Grunmach. Pp. 102. (Berlin: L. Simion, Nf.) 5 marks.

Report of the Department of the Naval Service for the Fiscal Year ending March 31, 1913. Pp. 128+plates. (Ottawa: C. H. Parmelee.) 10 cents.

A Manual for Masons, Bricklayers, Concrete Workers and Plasterers. By Prof. J. A. van der Kloes. Revised and adapted to the Requirements of British and American Readers by A. B. Searle. Pp. xii+235. (London: J. and A. Churchill.) 8*s*. 6*d*. net.

A Handbook of Wireless Telegraphy. By Dr. J. Erskine-Murray. Fifth edition. Pp. xvi+442. (London: Crosby Lockwood and Son.) 10*s*. 6*d*. net.

An Algebra for Preparatory Schools. By T. Dennis. Pp. viii+155. (Cambridge University Press.) 2*s*.

The Reform of the Calendar. By A. Philip. Pp. xiii+127. (London: Kegan Paul and Co., Ltd.) 4*s*. 6*d*. net.

Das Susswasser-Aquarium ein Stück Natur im Hause. By C. Heller. Zweite Auflage. Pp. vi+186. (Leipzig: Quelle und Meyer.) 1.80 marks.

Leitfaden für Aquarien- und Terrarien-Freunde. By Dr. E. Zernecke. New edition. By C. Heller and P. Ulmer. Pp. ix+456. (Leipzig: Quelle und Meyer.) 7 marks.

Methodik und Technik des naturgeschichtlichen Unterrichts. By Prof. W. Schoenichen. Pp. xiv+611+30 plates. (Leipzig: Quelle und Meyer.) 12 marks.

The Principle of Relativity in the Light of the Philosophy of Science. By P. Carus. Pp. 105. (Chicago and London: The Open Court Publishing Co.) 4*s*. net.

The Mechanistic Principle and the Non-Mechanical. By P. Carus. Pp. iv+125. (Chicago and London: The Open Court Publishing Co.) 4*s*. net.

Allen's Commercial Organic Analysis. Fourth edition. Edited by W. A. Davis and S. S. Sadtler. Vol. viii. Pp. x+696. (London: J. and A. Churchill.) 21*s*. net.

The Examination of School Children. By Prof. W. H. Pyle. Pp. v+70. (London: Macmillan and Co., Ltd.) 2*s*. net.

Zellen- und Gewebelehre. By Prof. K. von Bardeleben. Zweite Auflage. Pp. 96. (Leipzig und Berlin: B. G. Teubner.) 1.25 marks.

Entwicklungsgeschichte des Menschen. By Dr. A. Heilborn. Pp. viii+87. (Leipzig und Berlin: B. G. Teubner.) 1.25 marks.

Das Mikroskop. By Prof. W. Scheffer. Zweite Auflage. Pp. vi+100. (Leipzig und Berlin: B. G. Teubner.) 1.25 marks.

Das Meer: seine Erforschung und sein Leben. By Prof. O. Janson. Pp. iv+113. (Leipzig und Berlin: B. G. Teubner.) 1.25 marks.

Handbook of Photomicrography. By H. L. Hind and W. B. Randles. Pp. xii+292+plates. (London: G. Routledge and Sons, Ltd.) 7*s*. 6*d*. net.

Lectures on the Icosahedron and the Solution of Equations of the Fifth Degree. By Prof. F. Klein. Translated by Dr. G. G. Morrice. Second edition. Pp. xvi+289. (London: Kegan Paul and Co., Ltd.) 10*s*. 6*d*. net.

Ambidexterity and Mental Culture. By Dr. H. M. Jones. Pp. 102+plates. (London: W. Heinemann.) 2*s*. 6*d*. net.

The Birmingham Country. Its Geology and Physio-